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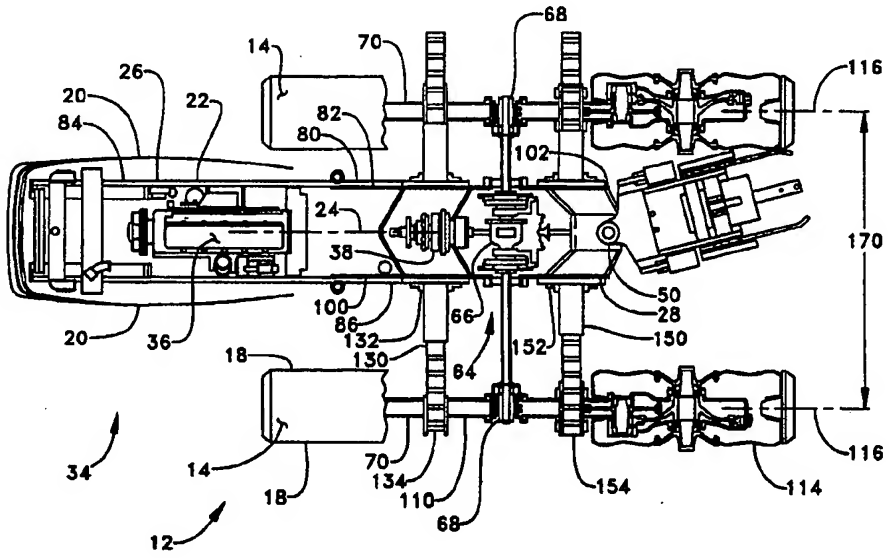

(57) Abstract

Present drive systems for use with an endless belted track fail to effectively and efficiently permit adequate variations being demanded for further utilization and diversification of the machine application requiring a more demanding diversity of gage adjustment. The present work machine (10) includes a drive system (64), including a front hardbar (130), and a rear hardbar (150) removably attached to a frame (22). A second end portion (134, 154) of the front and rear hardbar (130, 150) is connected to a roller frame (70). Interposed, the front hardbar (130) and the rear hardbar (150) is a power transmitting device (174) including a telescoping power connector (176) having a slip joint (192) therein.

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Description

DRIVE SYSTEM FOR A BELT DRIVEN WORK MACHINE

Technical Field

This invention relates generally to a work machine being driven by a rubber belted track and more particularly to a system for driving the rubber belted track.

Background Art

The popularity and nearly universal acceptance of rubber tired work machines over steel track in agricultural use has stemmed primarily from steel track's relatively higher noise levels, higher initial cost, lower maximum travel speed, and inability to travel on improved roads without inflicting unacceptable damage to the road's surface.

The recent advent of rubber belted track, wherein a continuous rubber belted track is entrained about a pair of wheels, has overcome a majority of the objections of steel track. Using such work machines has emphasized other problems, such as, the need for improved steering when towing an implement behind the machine for various purposes, including planting, plowing and leveling. Higher shock loading is being transmitted to the machine and the operator due to the machines increased speed and the operation of such machine's on hard surface roads. And, the increasing demand for further utilization and diversification of the machine application requiring a more demanding diversity of gauge adjustment.

The present invention is directed to overcome one or more of the problems as set forth above.

Disclosure of the Invention

In one aspect of the invention, a work machine has opposite sides and is comprised of a frame defining a front portion and a rear portion. An engine is positioned on the frame. A roller frame is connected at each of the opposite sides of the work machine. The roller frame includes a main support member having an idler wheel positioned near an end and a drive wheel positioned near the other end. A front hardbar is positioned on each of the opposite sides of the work machine. The front hardbar has a first end portion attached to the frame near the front portion and a second end portion is connected to a respective one of the roller frames. A rear hardbar is positioned on each of the opposite sides of the work machine. The rear hardbar has a first end portion attached to the frame near the rear portion, and a second end portion is connected to a respective one of the pair of roller frames. A pair of tracks is individually positioned on each opposite side of the work machine and defines a pair of sides. The individual track is entrained about the respective roller frame. The roller frame is positioned within the pair of sides. A tensioning system is operatively interposed the idler wheel and the drive wheel. A final drive is attached to a respective roller frame and is operatively attached to the drive wheel. A transmission system is operatively interposed the engine and the final drive. The transmission system includes a telescoping connector.

In another aspect of the invention, a work machine includes a main frame defining a front portion and a rear portion and having a pair of opposite sides. The work machine is comprised of a roller frame positioned on each of the opposite sides of the work machine. The roller frame integrally includes a main support member having an idler wheel positioned at one end and a drive wheel positioned at another end. A final drive includes a housing supported on the roller frame, a gear positioned within the housing and defining an input portion and an output portion. The output portion is in operational driving relationship with the drive wheel. A propulsion system includes an engine positioned on the front portion of the main frame, a transmission system and a power transmitting device operatively connected between the transmission system and the input portion of the gear. A pair of spaced apart hardbars are positioned on each of the opposite sides of the work machine. Each has a first end portion attached to the main frame. One of the pair of spaced apart hardbars is attached near said front portion and the other of the pair of spaced apart hardbars is attached near the rear portion. And, a second end portion is connected to the main support structure of the roller frame.

Brief Description of the Drawings

FIG. 1 is a side elevational view of the belt driven work machine embodying the present invention;

FIG. 2 is a partially-sectioned top elevational view of the belt driven work machine embodying the present invention;

FIG. 3 is a top elevational view of the belt driven work machine embodying the present invention; and

FIG. 4 is an enlarged sectioned top elevational view of a portion of the belt driven work machine embodying the present invention.

Best Mode for Carrying Out the Invention

Referring to FIGS. 1 and 2, a work machine 10, such as an agricultural tractor, is shown having a rubber belted track system 12. The rubber belted track system 12 utilizes a pair of endless rubber belted tracks 14, each having an inner surface 16 and a pair of sides 18. Each of the pair of belted tracks 14 is positioned on one of the opposite sides 20 of the work machine 10. The work machine 10 includes a main frame 22 having a central axis 24 extending between the pair of endless rubber belted tracks 14. The main frame 22 defines a front portion 26 and a rear portion 28. An operator's station 30 is supported on the main frame 22 and is surrounded by a cab 32, a propulsion system 34 including an engine 36 and a transmission system 38 which has at least a portion thereof supported on the main frame 22.

Attached to the main frame 22 along the rear portion 28 is a hitch 50. The hitch 50 includes a 3-point configuration and is pivotally mounted to the main frame 22. For example, the hitch 50 moves through an arch of about 15 degrees on either side of the central axis 24.

Each of the pair of endless rubber belted tracks 14 is powered individually. In this application, the transmission system 38 includes a mechanical drive system 64 utilizing a differential

steering mechanism 66. As an alternative, the transmission system 38 could use a pair of motors being driven by either a conventional hydraulic arrangement or an electrical arrangement. If the hydraulic arrangement was used, either a single pump or a pair of pumps could be used. The differential steering mechanism 66 transmits power from the engine 36 to a final drive 68 supported on a roller frame 70 within each of the pair of endless belted tracks 14, as will be defined later.

The main frame 22 in this application includes a two piece structure being defined by a first structure 80 and a second structure 82. However, as an alternative, a conventional single piece frame could be used without changing the essence of the invention. The first structure 80 has a first end portion 84 and a second end portion 86. The engine 36 is mounted near the first end portion 84.

The second structure 82 defines a first end portion 100 and a second end portion 102. The hitch 50 is attached to the second structure 82 near the second end portion 102.

The roller frame 70 is of generally conventional construction. A main support member 110 is positioned between an idler wheel 112 and a drive wheel 114 along a roller frame axis 116. The roller frame axis 116 is parallel with the central axis 24. Attached near a bottom 118 of the main support member 110 in a convention manner is a plurality of rollers 120 being in load supporting relationship to the inner surface 16 of individual ones of the pair of endless rubber belts 14. A tensioning system 122 is interposed the main support member 110 and the idler wheel 112 and is of conventional construction.

A front hardbar 130 is positioned in supporting relationship between the second structure 82 and the main support member 110. A first end portion 132 of the front hardbar 130 is removably attached to the second structure 82 nearer the first end portion 100 and between the first end portion 100 and the second end portion 102 of the second structure 82. For example, a plurality of fasteners, not shown, removably attach the front hardbar 130 to the second structure 82. A second end portion 134 of the front hardbar 130 is slidablely connected to a first member 136 extending from the main support member 110. In this application, the second end portion 134 has a cylindrical configuration which is positioned within a split collar 138. A pair of flanges 140 are attached to the split collar 138. An adjustable fastener 144, such as a bolt and nut, extends therebetween to affix the second end portion 134 of the front hardbar 130 relative to the roller frame 70.

A rear hardbar 150 is positioned in supporting relationship between the second structure 82 and the main support member 110. A first end portion 152 of the rear hardbar 150 is removably attached to the second structure 82 nearer the second end portion 102 and between the first end portion 100 and the second end portion 102 of the second structure 82. For example, a plurality of fasteners, not shown, attach the rear hardbar 150 to the second structure 82. A second end portion 154 of the rear hardbar 150 is slidablely connected to the main support member 110 in a fashion identical to that of the second end portion 134 of the front hardbar 130. In this application, the second end portion 154 has a cylindrical configuration which is positioned within a

split collar. A pair of flanges are attached to a respective pair of the ends of the split collar. An adjustable fastener, such as a bolt and nut, extends therebetween to affix the second end portion 154 of the rear hardbar 150 relative to the roller frame 70.

Thus, a reestablished gauge 170 is defined. The gauge 170 is the measured distance between the pair of roller frame axis 116 or, in most instances, twice the distance between the central axis 24 and the roller frame axis 116. Typical gauge measurements range from about 1524 cm, or 60 inches, to about 3048 cm, or 120 inches. In this application, the front hardbar 130 and the rear hardbar 150 are manufactured to include the gauge 170 measurement up to about 2235 cm or 88 inches. As best shown in FIG. 3, if a greater gauge 170 measurement is desired, a spacer 172 is positioned between each of the front hardbar 130 and the rear hardbar 150 and the second structure 82 on each of the pair of sides 20 of the work machine.

At the end of the main support member 110 of the roller frame 70 opposite the idler wheel 112 is the drive wheel 114. As best shown in FIG. 4 and being a part of the transmission system 38, interposed the drive wheel 114 and a power transmitting device 174, which in this application is a telescoping power connector 176, is the final drive 68. The final drive 68 includes a housing 178, which in this application is a multipiece housing, having a gear 180 therein being supported in a convention manner to provide rotational, power transmitting functions. The gear 180 includes an input portion 182 and an output portion 184. In this application, the output portion 184 has a chain 186 drivingly connected to the drive wheel 114. The output portion 184 drives the drive

wheel 114 which is in operational driving relationship with the inner surface 16 of the respective pair of endless rubber belted tracks 14. The present invention drives the endless rubber belted track with frictional force, but as an alternative, the drive wheel 114 could be adapted to driving a sprocket drive wheel which would mechanically drive a track.

The telescoping power connector 176 has a guard 188 positioned thereabout. The telescoping power connector 176 includes a first end portion 190, which in this application, slidably interfaces with the differential steering mechanism 66 and forms a slip joint 192. As an alternative, a mechanical connection to the differential steering mechanism 66 could have a universal joint attached thereto. A second end portion 196 of the telescoping power connector 176 has a driver portion 198 positioned thereon being in power driving relationship to the input portion 182 of the gear 180. In this application, a chain and sprocket configuration 200 transfers the power to the drive wheel 114. In this application, a gear reduction system 202 interposes the chain and sprocket configuration 200 and the drive wheel 114. As an alternative, other conventional drive systems could be used. As a further alternative, interposed is the first end 190 and the second end 196 of the telescoping power connector 176 could be a 192 which would allow the power to be mechanically transmitted therethrough when the gauge 170 is differently spaced or changed. For example, the slip joint 192 would include a first portion having a female spline formed thereon and a second portion having a male portion formed thereon. As the first portion and the second portion are drivingly connected and are free to slide

one relative to the other, the gauge 170 could easily be changed.

Thus, with the roller frame 70 having the tensioning system 122, the final drive 68, the plurality of rollers 120, and the drive wheel 114 integral therewith, a simplified system for individually driving the pair of endless belts 14 and allowing the gauge 170 of the work machine 10 to be easily changed or varied is provided. Furthermore, with the telescoping power connector 176 having the slip joint 192 therein, the power is easily transmitted from the power source, the engine 36, to the final drive 68 and, in turn, to the pair of endless belts 14.

Industrial Applicability

In operation with the present system, the versatility of the work machine 10 is greatly enhanced. With the self contained or integral roller frame 70 being positioned on opposite sides 20 of the work machine 10, the changing of the gauge 170 becomes simple, effective and much less time consuming. For example, with the gauge 170 being at about 1524 cm, or 60 inches, the gauge can be easily changed to about 2235 cm, or 88 inches, in an efficient and effective manner. The adjustable fasteners are loosened allowing the split collars 138 to become loose about the second end portion 134 of the front hardbar 130 and the second end portion 154 of the rear hardbar 150. Since the driving power from the engine 36 is transmitted through the telescoping power connection 176, which is free to slide and extend or retract with the roller frame 70, the roller frame 70 can be moved without further disassembly. However, since the

telescoping power connection 176 is a rotating member, the guard 188 will be provided.

If, on the other hand, the gauge 170 needs to be extended beyond the 2235 cm, or 88 inches, additional disassembly and reassembly must take place. For example, the first end portion 132 of the front hardbar 130 must be removed from the second structure 82 and the spacer 172 positioned between the second structure 82 and the first end portion 132 of the front hardbar 130. At the same time, the first end portion 152 of the rear hardbar 150 must be removed from the second structure 82 and the spacer 172 positioned between the second structure 82 and the first end portion 152 of the rear hardbar 150. Again, since the telescoping power connection 176 is a rotating member, the guard 188 will be provided.

Thus, the combination of the integral roller frame 70, the slidable features of the front and rear hardbars 130,150 and the flexibility of the power transmitting device 174 provide a more versatile work machine 10. The gauge 170 can be easily changed in a simple, effective and timely manner with the structure, as defined in the above invention.

Other aspects, objects and advantages of this invention can be obtained from a study of the drawings, the disclosure and the appended claims.

Claims

1. A work machine (10) having opposite sides (20) comprising:

a frame (22) defining a front portion (26) and a rear portion (28);

an engine (36) being positioned on said frame (22)

a roller frame (70) being connected at each of said opposite sides (20) of said work machine (10) said roller frame (70) including a main support member (110) having an idler wheel (112) positioned near an end and a drive wheel (114) positioned near the other end;

a front hardbar (130) being positioned on each of said opposite sides (20) of said work machine (10), said front hardbar (130) having a first end portion (132) being attached to said frame (22) near said front portion (26) and a second end portion (134) being connected to a respective one of said pair of roller frames (70);

a rear hardbar (150) being positioned on each of said opposite sides (20) of said work machine (10), said rear hardbar (150) having a first end portion (152) being attached to said frame (22) near said rear portion (28), and a second end portion (154) being connected to a respective one of said roller frames (70)

a pair of tracks (14) being individually positioned on each opposite side (20) of said work machine (10), each defining a pair of sides (18), each of said pair of tracks (14) being entrained about the respective roller frame (70), said roller frame (70) being positioned within the pair of sides (18);

a tensioning system (122) being operatively interposed said idler wheel (112) and said drive wheel (114);

a final drive (68) being attached to a respective roller frame (70) and being operatively attached to the drive wheel (114);

a transmission system (38) being operatively interposed said engine (36) and said final drive (68), said transmission system (38) including a telescoping connector (176).

2. The work machine (10) of claim 1 wherein said drive wheel (114) frictionally drives a respective one of said pair of tracks (14).

3. The work machine (10) of claim 2 wherein said tensioning system (122) applies a force adequate to tension said drive wheel (114) into frictional driving relationship with said respective one of said pair of tracks (14).

4. The work machine (10) of claim 2 wherein said force distally spaces said drive wheel (114) from said idler wheel (112).

5. The work machine (10) of claim 1 wherein said first end portion (132,152) of said front hardbar (130) and said rear hardbar (150) are removably attached to said frame (22).

6. The work machine (10) of claim 5 wherein said first end portion (132,152) of said front hardbar (130) and said rear hard bar (150) includes a

spacer (172) interposed said first end portions (132,152) and said frame (22).

7. The work machine (10) of claim 1 wherein said telescoping connection (176) is positioned intermediate said front hardbar (130) and said rear hardbar (150).

8. The work machine (10) of claim 7 wherein said transmission system (38) includes a differential steering mechanism (66) and said telescoping connection (176) includes a first end (190) having a slidable interfacing with said differential steering mechanism (66).

9. The work machine (10) of claim 1 wherein said frame (22) includes a two piece structure defining a first structure (80) and a second structure (82) being pivotably connected.

10. A work machine (10), including a main frame (22), defining a front portion (26) and a rear portion (28) and a pair of opposite sides (20) being defined by said work machine (10), said work machine (10) comprising;

a roller frame (70) being positioned on each of said opposite sides (20) of said work machine (10), said roller frame (70) integrally including a main support member (110) having an idler wheel (112) positioned at one end and a drive wheel (114) positioned at another end, a final drive (68) including a housing (178) being supported on said roller frame (70), a gear (180) being positioned within said housing (178) and defining an input

portion (182) and an output portion (184), said output portion (184) being in operational driving relationship with said drive wheel (114);

a propulsion system (34), including an engine (36), being positioned on said front portion (26) of said main frame (22), a transmission system (38) being at least partially attached to said main frame (22) and a power transmitting device (174) being operatively connected between said transmission system (38) and said input portion (182) of said gear (180); and

a pair of spaced apart hardbars (130,150) being positioned on each of said opposite sides (20) of said work machine (10), each having a first end portion (132,152) being attached to said main frame (22), one of said pair of spaced apart hardbars (130,150) attached near said front portion (26) and the other of said pair of spaced apart hardbars (130,150) being attached near said rear portion (28) and a second end portion (134,154) of said pair of spaced apart hardbars (130,150) being connected to said main support structure (110) of said roller frame (70).

11. The work machine (10) of claim 10 wherein said power transmitting device (174) includes a telescoping power connector (176).

12. The work machine (10) of claim 11 wherein said power transmitting device (174) further includes a guard (188) positioned about said telescoping power connector (176).

13. The work machine (10) of claim 11 wherein said transmission system (38) includes a mechanical drive system (64).

14. The work machine (10) of claim 13 wherein said telescoping power connector (176) includes a first end (190) slidably interfacing with said mechanical drive system (64).

15. The work machine (10) of claim 14 wherein said mechanical drive system (64) includes a differential steering mechanism (66).

16. The work machine (10) of claim 10 wherein said final drive (68) further includes a chain (186) drivingly connecting said output portion (184) of said gear (180) to said drive wheel (114).

17. The work machine (10) of claim 10 further including a hitch (50) attached to said rear portion (28) of said main frame (22).

18. The work machine (10) of claim 17 wherein said hitch (50) includes a 3-point configuration.

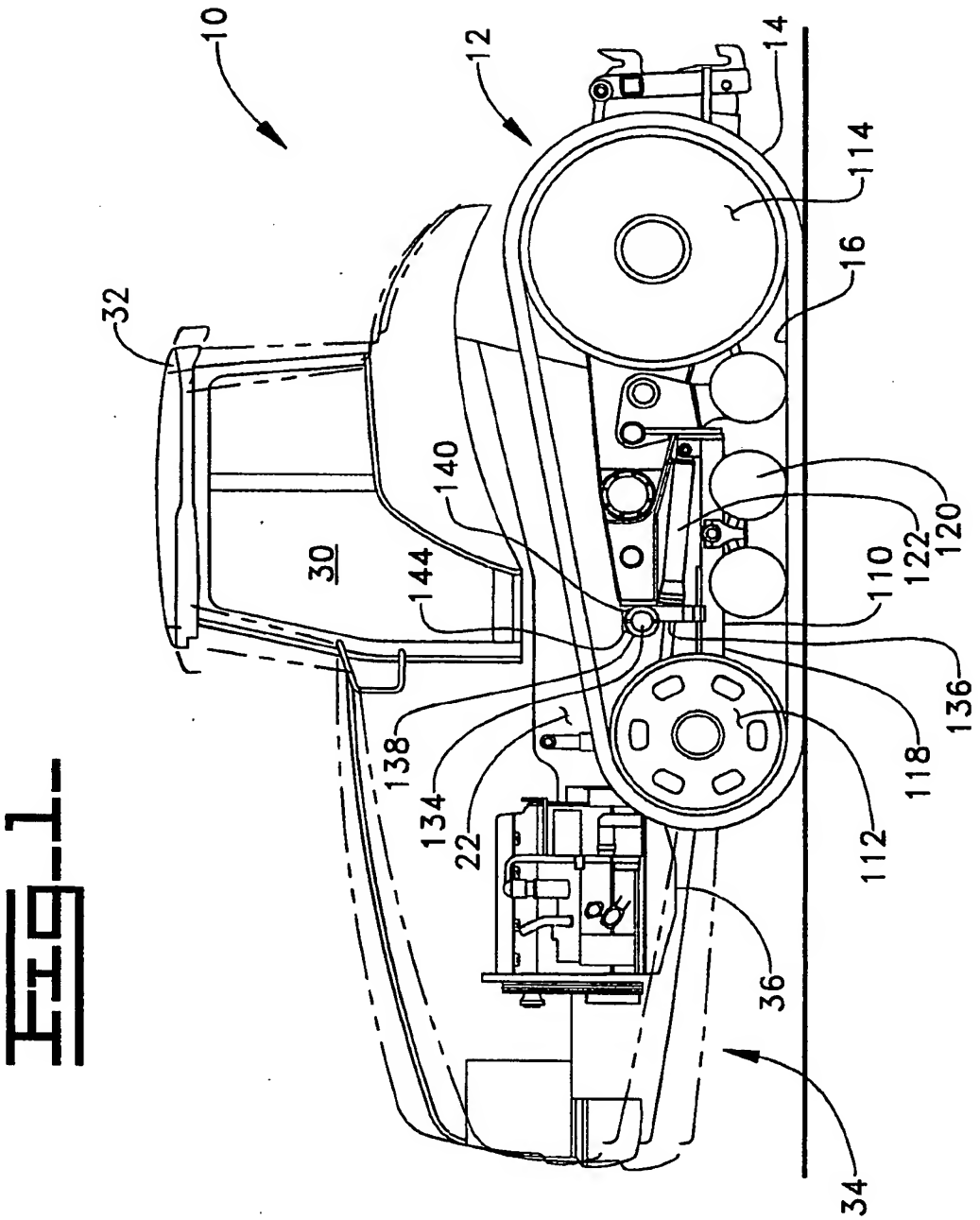
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Fig. 1

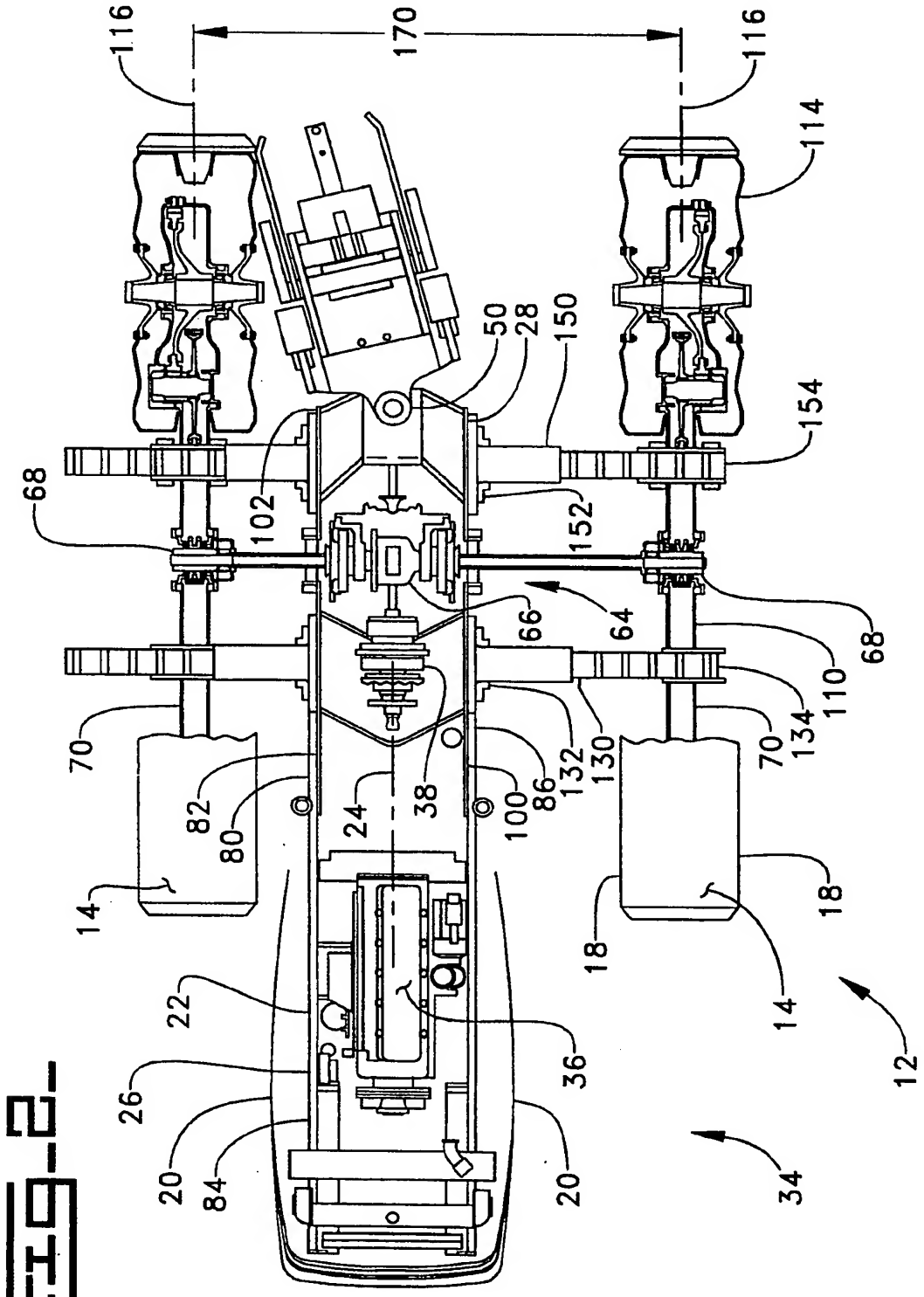
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Fig-2

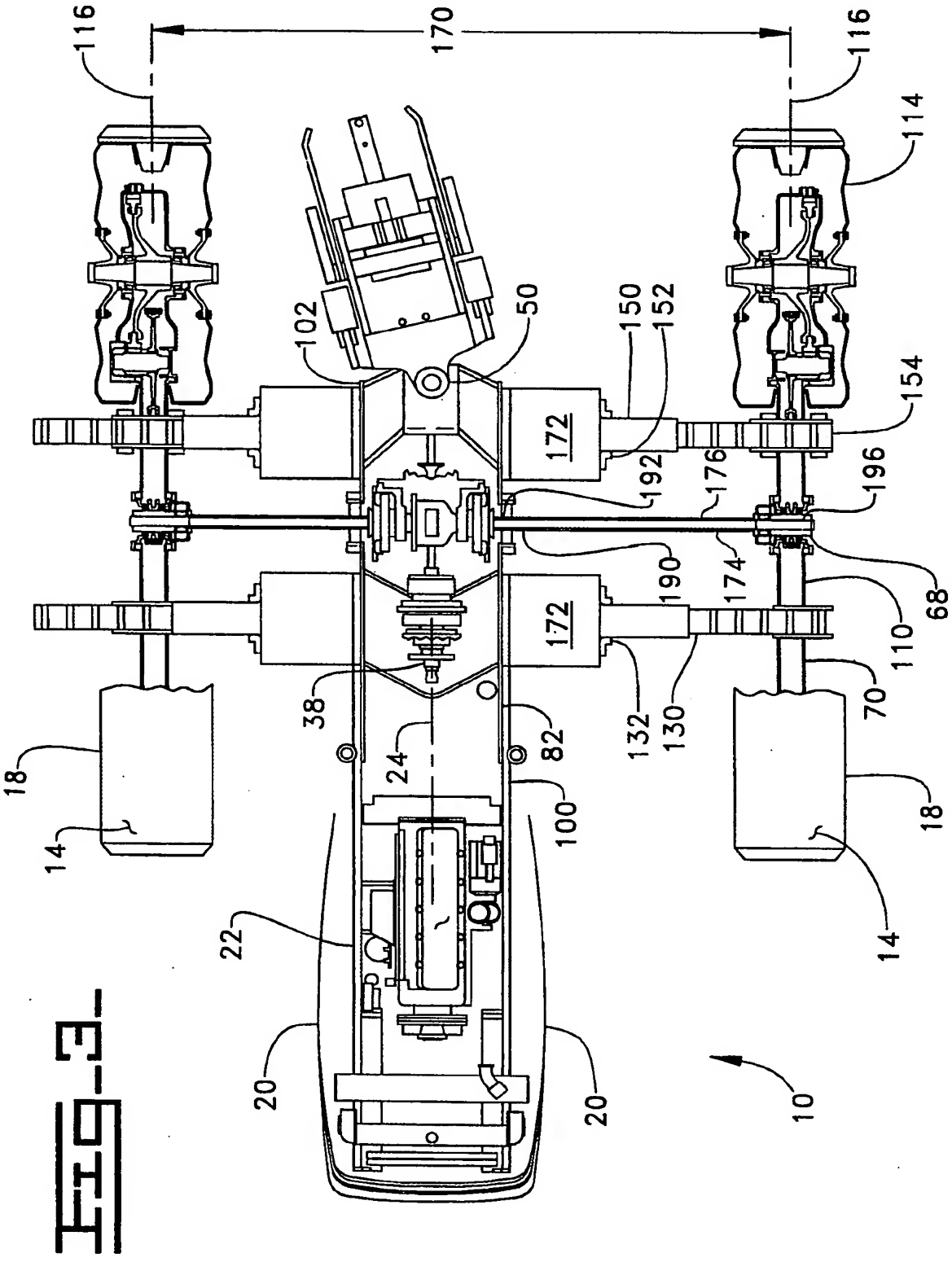
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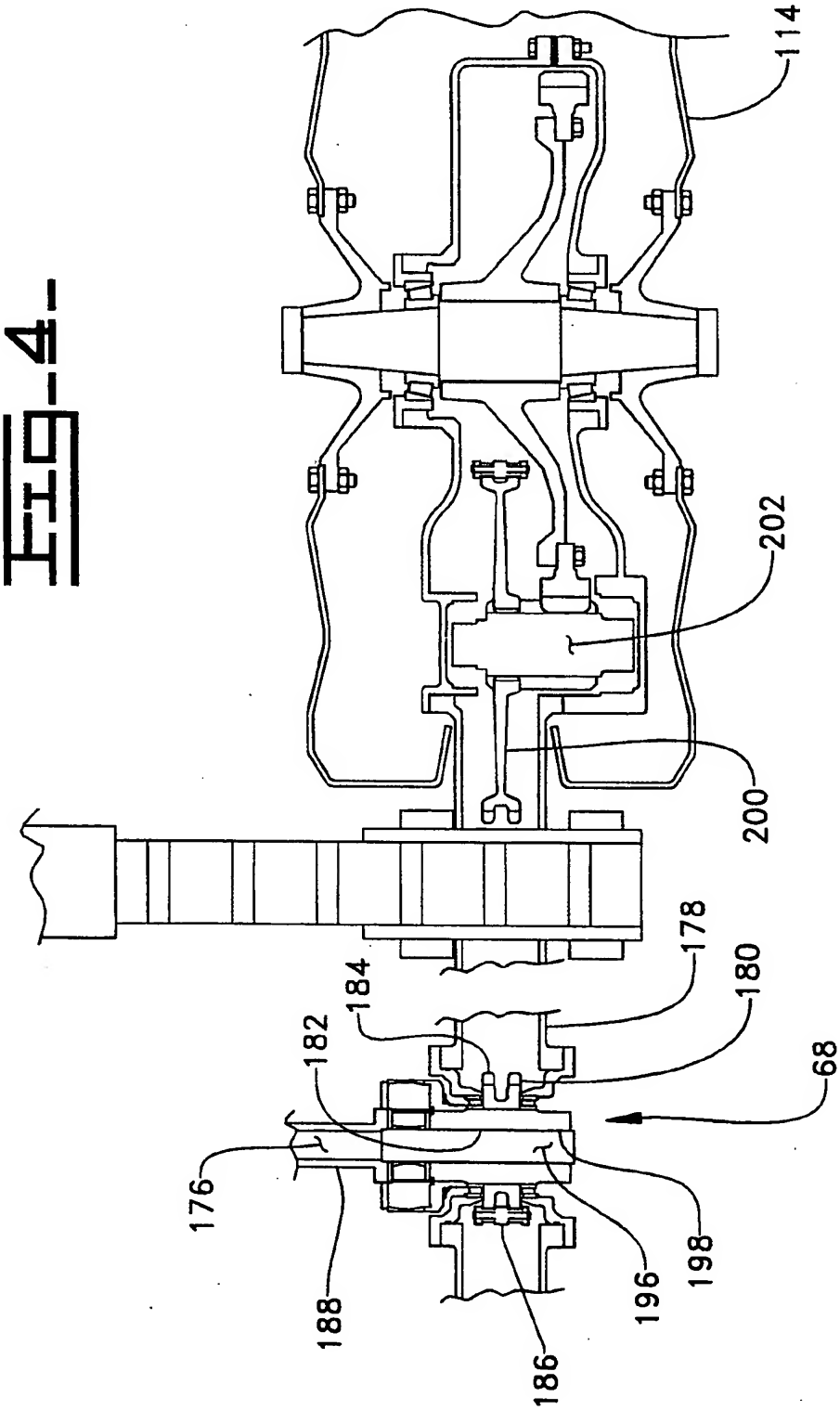
Fig-3-

Fig-4-



INTERNATIONAL SEARCH REPORT

Inter ·ional application No.
PCT/US 98/01919

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B62D 55/00, B62D 55/084
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B62D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC,WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	GB 113102 B (HUBERT AVERY HATFIELD), 14 February 1918 (14.02.18), page 4, line 13 - line 36, figures 1-2	1-5,7-18
Y	US 2763330 A (K.F. POTTER), 18 Sept 1956 (18.09.56), column 1, line 57 - line 60; column 2, line 1 - column 3, line 40, figures 1-10	1-5,7-18
A	EP 0721879 A2 (CATERPILLAR INC.), 17 July 1996 (17.07.96)	1-6,10
A	US 3037571 A (L.L. ZELLE), 5 June 1962 (05.06.62)	1,5-6,10

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
12 May 1998	12.06.98
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+ 31-70) 340-3016	Authorized officer Björn Salén

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 98/01919

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4132317 A (ARENDT ET AL), 2 January 1979 (02.01.79), abstract	1,10